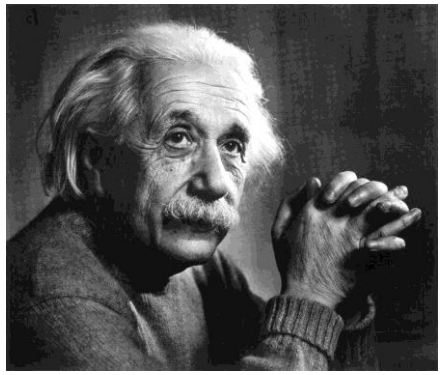
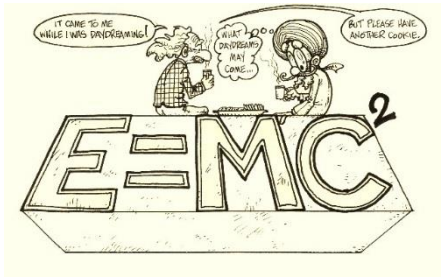
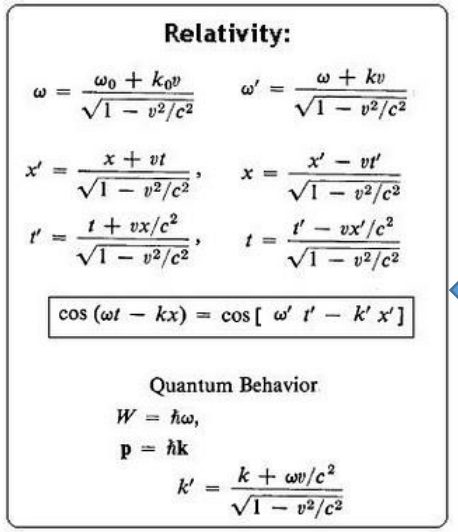
1905: A proposal of Special Relativity



Albert Einstein: 1879-1955



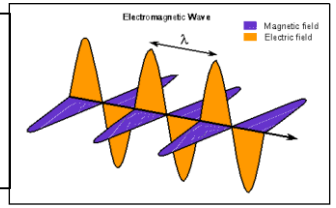


Postulates

The speed of light appears to be a constant, not only from the Michelson-Morley experiment but also from it's expected value in a vacuum as predicted from electricity and magnetism.

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

Nothing can go faster than the speed of light since nothing has been measured to.



The laws of physics must be the same in all frames of reference.

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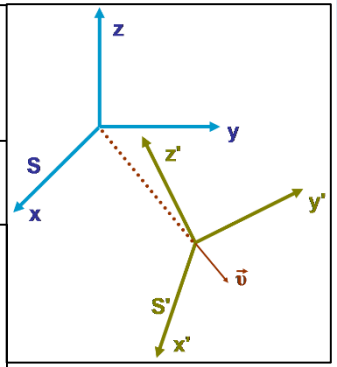
A new system of equations relating one reference frame to another, one that is moving relative to another, must be formulated in order to accommodate what is being observed.



Implications

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When viewing a reference frame moving close to the speed of light, time appears to dilate (slow down) in that frame.

$$\Delta t = \frac{t_0}{\sqrt{1 - \left(\frac{v}{c}\right)^2}}$$

&

When viewing a reference frame moving close to the speed of light, length appears to contract in that frame.

$$\Delta L = L_0 \sqrt{1 - \left(\frac{v}{c}\right)^2}$$

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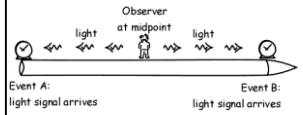
Synchronization is impossible between reference frames when events occur at different locations.



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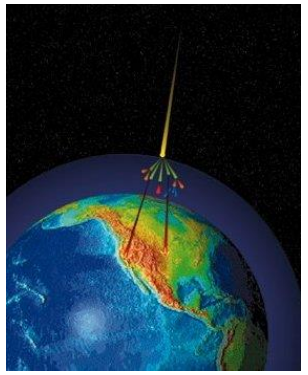
After some equation manipulation it is shown that there is energy associated with mass, even when it is at rest.

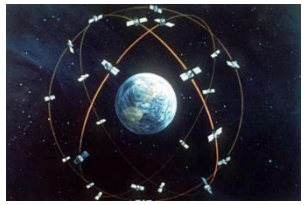
$$E_0 = mc^2$$

Some Proof

Muons having the ability to make it to the surface of the earth even though their stationary lifetime isn't long enough for it to travel that far.



The necessity to synchronize the clocks on Global Positioning Satellites.



The addition of velocities near to the speed of light as seen many times in particle accelerators.

Etc.